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EVALUATION OF LANDS FOR RECREATIONAL SNOWMOBILE USE (GUIDELINES--ETC(U)
MAY 81 R M LACEY, R S BARAN, W D SEVERINGHAUS

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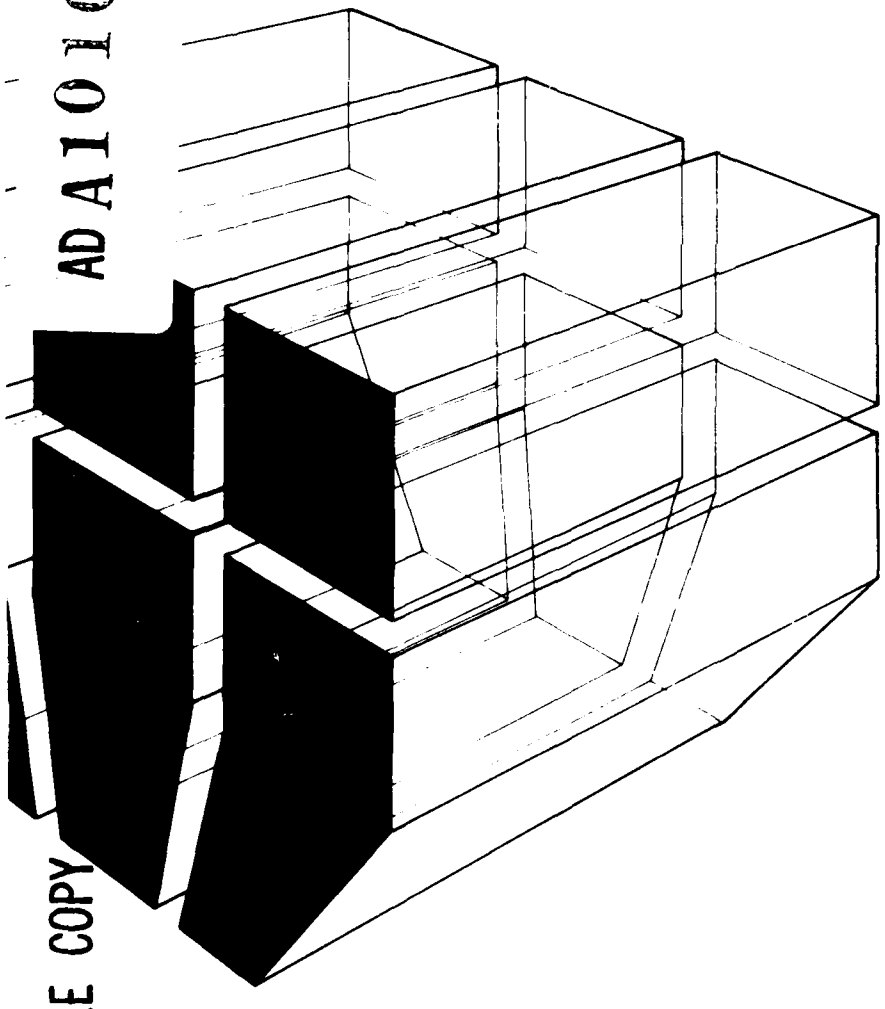
TECHNICAL REPORT N-105
May 1981
Guidelines for Natural Resources Management
and Land Use Compatability

EVALUATION OF LANDS FOR RECREATIONAL SNOWMOBILE USE

LEVEL II



by
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This report describes a recommended method to evaluate land areas on Army installations for use by recreational snowmobiles. Personnel normally charged with land management responsibilities can perform this evaluation.

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The method includes recommended procedures to identify incompatible land uses, establish noise buffer zones, evaluate biological and terrain suitability, choose candidate areas or corridors, and establish trails. Factors considered in the evaluation method include user participation, existing trail systems, user demand, trail signing, vehicle operating conditions, and environmental assessment and monitoring.

FOREWORD

This investigation was performed for the Directorate of Military Programs, Office of the Chief of Engineers (OCE), under Project 4A762720A896, "Environmental Quality for Construction and Operation of Military Facilities"; Task B, "Land Use Planning"; Work Unit 024, "Guidelines for Natural Resources Management and Land Use Compatibility." The applicable QCR is 3.01.001. The OCE Technical Monitor was Mr. Donald Bandel, DAEN-MPO-B.

The research was performed by the Environmental Division (EN), U.S. Army Construction Engineering Research Laboratory (CERL). Dr. R. K. Jain is Chief of EN.

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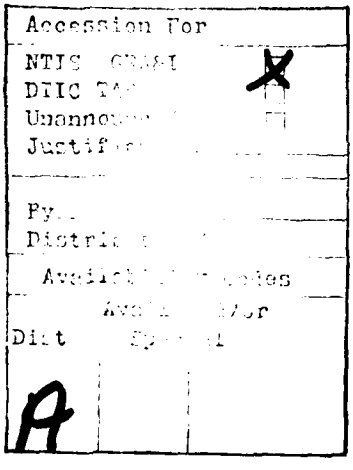

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1 INTRODUCTION

Background

About 10 million off-road vehicles (ORVs) in the United States are used for recreational purposes.[1] Off-road recreational vehicles (ORRVs) include snowmobiles, dune buggies, trail bikes, all-terrain vehicles, and four-wheel vehicles.

Pressure from ORRV enthusiasts for land on which to operate their vehicles, and the concerns of environmental groups have made the ORRV issue controversial. Presidential Executive Orders require Federal agencies which manage publicly owned land to consider both sides of the issue.[2] In response to these Executive Orders, Army Regulation (AR) 210-9 establishes uniform policies, procedures, and criteria for controlling off-road travel by ORRVs and prescribes appropriate operating conditions for such vehicles.[3] The goal of AR 210-9 is to allow persons to enjoy ORRV use while considering the long-term stability of environmental resources.

To help Army personnel meet this goal, researchers at the U.S. Army Construction Engineering Research Laboratory (CERL) have developed a recommended method to evaluate land areas for ORRV use.

Purpose

The purpose of this report is to describe a recommended systematic method for evaluating land for recreational snowmobile use.

Approach

Much of the technical information necessary to develop the evaluative method was obtained in three ways. First, CERL conducted a literature search of available documentation on snowmobiles' environmental impact, user characteristics, and trail development. Second, Federal and State snowmobile program managers and industry representatives were contacted for all their available information about existing programs (Appendix A). Third, natural-resource personnel at Army major commands were asked how many requests they had received for use of Army land.

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[1] David Sheridan, Off-Road Vehicles on Public Land (President's Council on Environmental Quality, 1979), p 2.

[2] Executive Order No. 11644, "Use of Off-Road Vehicles on the Public Lands," Federal Register, Vol 37, No. 27 (8 February 1972), pp 2877-2878; and Executive Order No. 11989, "Off-Road Vehicles on Public Lands," Federal Register, Vol 42, No. 101 (24 May 1977), pp 26,959-26,960.

[3] Installations -- Use of Off-Road Vehicles on Army Land, Army Regulation (AR) 210-9 (Headquarters [HQ], Department of the Army [DA], 1 July 1978).

CERL then decided to examine Fort McCoy, WI, to learn how to apply this technical information. Fort McCoy has worked with State and county officials and user groups to establish two trails through the installation. With the cooperation of the Facilities Engineer's staff at Fort McCoy, CERL researchers examined in detail the establishment of these trails.

Scope

The recommended method described in this report focuses on the purely recreational use of snowmobiles. Neither competitive events nor other types of ORRVs are considered.

Mode of Technology Transfer

The information and method described in this report will be distributed to field personnel in an Engineer Technical Note. This guidance -- and guidance which considers other types of ORRVs, as well as competitive events -- will be incorporated into a new Technical Manual.

Overview of the Evaluative Method

The method described in this report was developed as part of the Army's environmental research program. Initial guidance to evaluate areas for trailbike use has been issued as Engineer Technical Note (ETN) No. 80-9 and CERL Technical Report N-86.[4] However, not all the trailbike information is applicable to snowmobiles. The various types of ORRVs were designed to be used for different purposes and to travel across different surfaces. For example, trailbikes generally run on a system of loop trails, and are operated mostly to test rider and machine. But snowmobiles usually operate along longer, straighter trails to transport the rider from point to point. Moreover, the various ORRVs are used in different seasons, so the vehicles' effects on the environment also differ. Therefore, flexible techniques are needed for evaluating areas where ORRVs might be used.

The evaluative method explained here primarily deals with the environmental factors considered in AR 210-9. However, other factors, such as user participation, trail design, and operating conditions are also considered.

CERL recognizes that lands under Army control were acquired solely for national defense purposes and that other uses are secondary to mission needs. Therefore, the method begins by eliminating from consideration lands necessary to meet mission requirements. The method continues with procedures to establish noise buffer zones, choose candidate areas, evaluate biological

[4] Evaluation of Areas for Off-Road Recreational Motorcycle Use, Engineer Technical Note (ETN) 80-9 (DA, Office of the Chief of Engineers [OCE], 4 March 1980); R. M. Lacey, H. E. Balbach, R. S. Baran, and R. G. Graff, Evaluation of Areas for Off-Road Recreational Motorcycle Use, Volume I: Evaluation Method, and Volume II: Alternate Soil Suitability Determination Methods, Technical Report N-86 (U.S. Army Construction Engineering Research Laboratory [CERL], September 1980).

suitability, examine terrain characteristics, designate trails, and choose alternative candidate areas.

The procedures included in the method are designed for persons in installation natural resource, environmental, and master planning offices. Use of the procedures should be coordinated with all appropriate offices having responsibilities under the authority of AR 28-1, AR 190-5, AR 190-5-1, AR 200-2, AR 210-20, AR 405-80, and AR 420-74.[5]

[5] Welfare, Recreation, and Morale -- Army Morale Support Activities, AR 28-1 (HQ, DA, 15 February 1979); Military Police -- Motor Vehicle Traffic Supervision, AR 190-5 (Departments of the Army, Navy, Air Force, and the Defense Supply Agency, 1 August 1973); Military Police -- Registration of Privately-Owned Motor Vehicles, AR 190-5-1 (HQ, DA, 15 July 1978); "Environmental Quality: Environmental Effects of Army Actions," AR 200-2, Federal Register, Vol 45, No. 204 (20 October 1980), pp 69,215-69,238. Master Planning for Army Installations, AR 210-20 (HQ, DA, 26 January 1976); Real Estate -- Granting Use of Real Estate, AR 405-80 (HQ, DA, 1 February 1979); and Natural Resources -- Land, Forest, and Wildlife Management, AR 420-74 (HQ, DA, 1 July 1977).

2 HOW TO EXAMINE EXISTING LAND USE

Input

Major sources of information about current land uses include the Installation Master Plan, Land Management Plan, Endangered Species Inventory, Historic/Archaeologic Resources Management Program, and the Office of the Director of Plans and Training. These sources are not exclusive. Any source which identifies the location of sensitive, fragile, and unique land uses or areas should be consulted.

Incompatible Land Uses

After all available sources of information have been studied, certain parts of an installation must be eliminated from consideration as areas for snowmobile use. Incompatible land use categories are based on the principles and examples in AR 210-9, or are land uses generally known to conflict with ORRV operation. AR 210-9 generally describes several categories of lands which are to be specifically declared unavailable for ORRV use -- areas that are:

1. Necessary to the safe and secure military function of an installation

2. Used for purposes which are assumed to be incompatible with ORRVs

3. Known or believed to be unsafe to ORRV participants or nonparticipants

4. Identified as containing a valuable natural, historic, or other resource which would be compromised by other use.

Table 1 lists not only several examples of sensitive and incompatible land uses, but also points to be considered when suspect areas are examined for possible classification under any of these categories. Table 1 is not all-inclusive, and any land use which uniformly conflicts with snowmobile operation should be eliminated from consideration as an ORRV-use area and should be marked on a base map. (See Figure 1 for a simplified example.)

Special Considerations

Two very controversial environmental impacts were identified during the development of the evaluative method described in this report. Since there is information both supporting and disputing these impacts, qualified biologists and foresters should be consulted for recommendations.

Table 1

Land Uses and Areas Which Are Incompatible
With Snowmobile Use

Examples of Land Uses Which Conflict With ORRV Use (Listed by Category of Conflict)	Considerations Which Place Land Uses in Categorical Conflict
Safety and Security of Military Function	
Land Uses	Conflict Considerations
Active bivouac areas	National security
Active maneuver areas	Personal safety of Army personnel
Airfield aprons & approach zones	Physical security of personal property
Demolition areas	Live fire
Explosives storage	Unexploded ordnance
Impact areas	Quantity-distance limits
Motor pools	Tactical vehicle operations
Incompatible Uses	
Land Uses	Conflict Considerations
Administrative areas	Noise
Agricultural outleases	Dust
Campgrounds	Aesthetics
Churches	Traffic congestion
Family housing	Vehicle operation
Hospitals	Property security
Libraries	Vandalism
Outdoor theaters	
Schools (military and dependent)	
Troop housing	
Participant and Nonparticipant Safety	
Land Uses	Conflict Considerations
Active hunting areas	Live fire
Active landfills	Steep slopes
Active maneuver areas	Loose surface materials
Frozen bodies of water	Moving tactical vehicles
Impact areas	Unexploded ordnance
Potable water storage	Water quality
Active quarries	Thin ice
	Recreation conflict

Table 1 (Cont'd)

Examples of Land Uses Which Conflict With ORRV Use (Listed by Category of Conflict)	Considerations Which Place Land Uses in Categorical Conflict
Natural and Other Resources Locations	
Land Uses	**Conflict Considerations**
Archaeological sites	Noise
Breeding, migration, or nesting areas	Soil compaction
Food plots and feeding areas	Vegetation damage
Historic sites and structures	Air emissions
Paleontologic sites	Petroleum spills
Petroglyphs	Vandalism
Rare, endangered, or threatened plants, animals, and fish	Human presence and disruption
Timber plantations	Soil erosion
Wetlands	Dust
	Animal harassment
	Aesthetics
	Siltation
	Turbidity
	Poaching

Wildlife

During the winter months, wildlife are generally weak from lack of food. This condition can be compounded, and can result in death from exhaustion or exposure, if animal activity increases as a result of the presence of man and machine. The wintering condition of resident animals in candidate areas should be examined before an area or trail is opened for use. Special attention should be given to identifying -- and eliminating from consideration for trail development -- areas where wildlife concentrate and feed during winter months, e.g., deer yards.

Vegetation

When snowmobiles run over plants or compact the snow too firmly, the early spring growth of vegetation can be affected. As a result, special consideration should be given to prohibiting snowmobile operation where predominant vegetation is being managed for commercial or other use -- e.g., winter wheat or alfalfa fields, timber plantations, and grassland preserves. (Note also the snow cover and use conditions recommended in Chapter 7.)

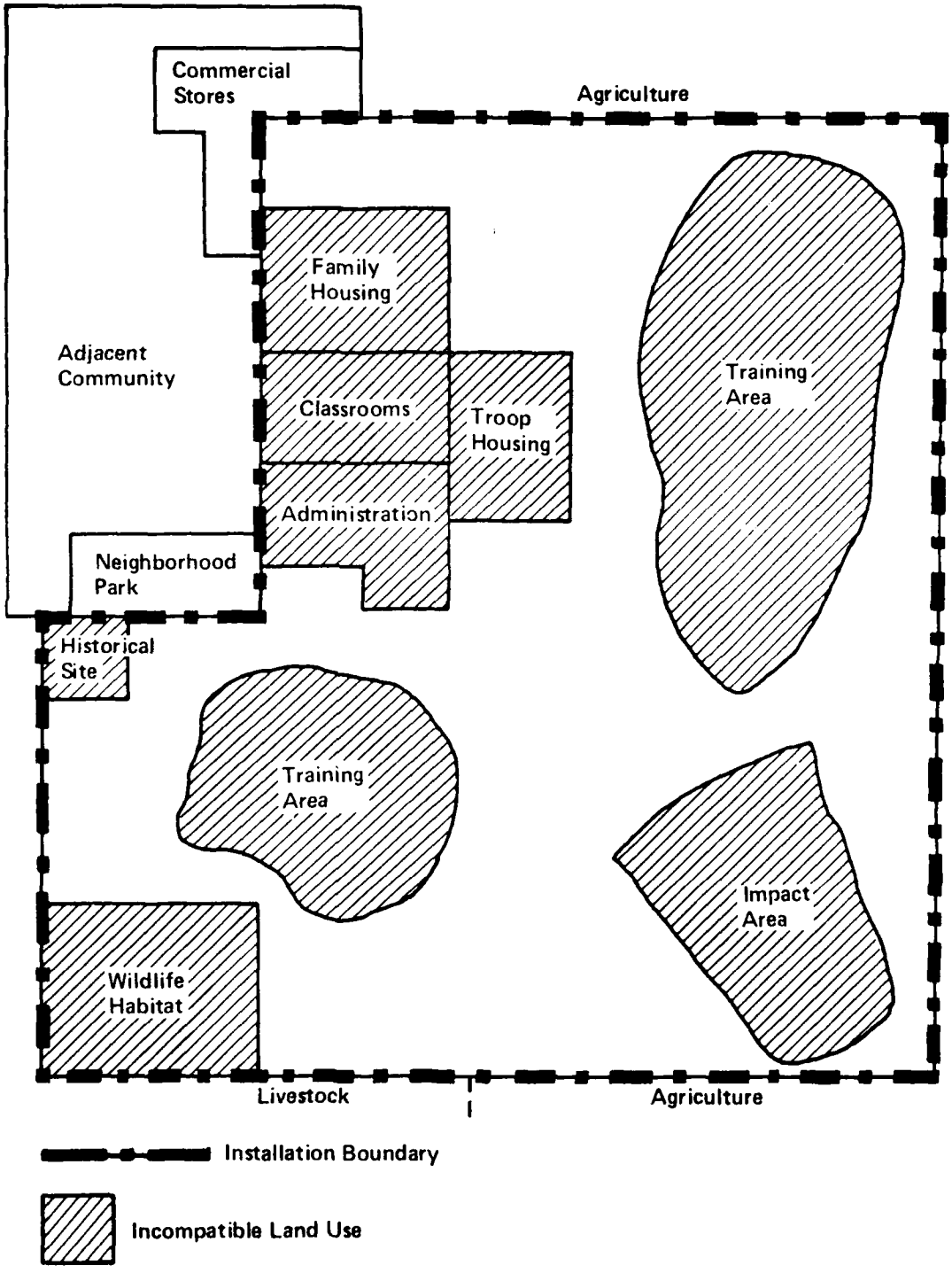

Figure 1. Base map identification of incompatible land uses.

Other Considerations

Studies identifying the impact of snowmobile use over wetlands and ice are limited and lack quantitative information. For environmental as well as safety concerns, it is recommended that areas containing wetlands and frozen bodies of water be eliminated from consideration for use. A certain amount of acreage next to these areas should also be eliminated so users will not be tempted to leave developed trails and cross wet or frozen surfaces.

Mapping of Incompatible Land Uses

Once all incompatible land uses and areas have been identified, they should be marked on an installation map. (See Figure 1 for a simplified example.) This map is then used as a working base map for other parts of the evaluation method. A publishable map will not be needed.

3 HOW TO ESTABLISH NOISE BUFFER ZONES

Input

It will be necessary to locate noise-sensitive land uses on and adjacent to an installation, estimate the number of snowmobiles expected to use an area or trail, and estimate the average noise level generated by the snowmobiles.

Noise Sensitive Land Uses

Many land uses are sensitive to excessive noise levels. A hospital or nursing home would be "sensitive" to a nearby snowmobile-use area. Appendix B explains a method for determining the distance necessary for noise attenuation (DNNA). Table B1 has been adapted from Figure 4-5 of Technical Manual (TM) 5-803-2, which identifies sound-level requirements for buildings and land uses.[6] Each land use identified in the table is considered noise-sensitive and has a value indicating a maximum acceptable sound-level requirement. Any of these land uses existing on the installation, or adjacent to an installation boundary, should be identified on the base map.

Projected Demand

Projected demand is the average daily seasonal use expected for the area. It is determined by projecting the number of vehicles which will be using a trail during each day of the snowmobile season (including days of no use), adding the numbers, and dividing by the number of days in the season. (For the procedures provided in this report, a season is defined as the number of days between the dates of the first and last adequate snow accumulation, but not fewer than 60 days.) A quantitative procedure to estimate this use is not included in this guidance since little information is currently available for projecting such demand. The best sources for determining demand are users and persons from an installation's outdoor recreation staff -- specifically, individuals who know how to project recreation demand or who may have received requests from users. Assistance from representatives of the Heritage Conservation and Recreation Service or appropriate State agencies could be of value.

Noise Levels

Noise levels generated by snowmobiles vary depending on the year of manufacture and the amount of user modification. Snowmobile industry standards, which were adopted in 1976, place sound levels at no greater than 73 decibels (dBA) at 15.24 m (50 ft) for a snowmobile traveling at 15 mph, and 78 dBA for a snowmobile at full throttle. Older models and modified machines can generate up to 120 dBA. To estimate noise levels accurately, users and recreation staffs should be consulted to find out what types of vehicles will probably be used. On many installations, the Preventive Medicine Office,

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[6] Environmental Protection -- Planning in the Noise Environment, Technical Manual (TM) 5-803-2 (Departments of the Air Force, Army, and Navy, 15 June 1978).

Environmental Office, or the Provost Marshal may be able to supply equipment which can measure snowmobile noise levels. Generally, users will cooperate in taking sound-level measurements of their vehicles.

Distance Necessary for Noise Attenuation

Based on projected demand and estimated average noise level, the DNNA for each noise-sensitive land use can be computed. The DNNA is the distance a snowmobile trail would have to be located from a noise-sensitive land use to meet recommended maximum acceptable noise-level requirements. For example, a snowmobile trail for which the projected average daily seasonal use is 20 snowmobiles, each generating an average of 78 dBA at full throttle, cannot be within 542 m (590 yd) of family housing.

Mapping Noise Buffer Zones

Once DNNAs for each noise-sensitive land use are identified, they must be marked on the base map (see p 13). To do this, lines are drawn around each noise-sensitive land use at that distance, corresponding to the scale of the map, which illustrates the minimum distance outside which a snowmobile trail could be located (Appendix B). The areas between these lines and the noise-sensitive land uses are the noise buffer zones. The acreage in these zones, as well as the acreage in the noise-sensitive land use, should be eliminated from consideration as snowmobile-use areas. It is recommended that the noise buffer zones be based on generous estimates of projected demand to accommodate both any unexpected growth in demand and increased use during severe winters with more than the usual number of days with adequate snow accumulation.

Limited-Use Alternative

On many installations, there may be so much demand that the area required for buffer zones will eliminate nearly all available acreage. In these cases, use at any established snowmobile trail will have to be limited, despite demand. The limited-use alternative for ensuring that maximum acceptable sound levels are not exceeded requires altering the order in which the evaluation steps are completed. This is done by choosing candidate areas (Chapter 4), evaluating terrain (Chapter 6), and examining biological and other environmental factors (Chapters 5 and 7) before using the noise equation or the tables in Appendix B. If an environmentally acceptable area is identified by these examinations, a candidate trail's distance from noise-sensitive land uses becomes a known variable. The number of snowmobiles which may be allowed on the trail is the unknown factor. By using all known variables as input and solving Eq B1, the average daily number of snowmobiles which can reasonably use the trail during the season is determined. If a snowmobile trail is established, this average number cannot be exceeded without unacceptable noise impacts on adjacent land uses.

4 HOW TO CHOOSE CANDIDATE AREAS

Input

The base map described in Chapters 2 and 3 is used to decide which areas (corridors) on an installation may be candidates for snowmobile trail development. Other factors which must be considered are projected demand, user preferences, and site accessibility.

General Criteria

Research indicates that areas now used by ORRVs range from 5 to 800 ha (12 to 2000 acres) or greater, depending on the type of vehicle, intensity of user demand, type of terrain, available land area, and trail configuration. The length of trails can range from about 3.2 km (2 mi) to greater than 161 km (100 mi).

Acreage

It is recommended that candidate areas (corridors) developed for snowmobile use should be no greater than 150 ha (375 acres). This is estimated to be the maximum which the average installation could devote to such use. Further site evaluation may indicate that portions of candidate areas are unacceptable, and the actual area available will have to be reduced. The exact size of a specific candidate area will depend upon available acreage. Generally, areas chosen for snowmobile use are specific corridors to allow for trail development rather than general cross-country use.

Site Requirements

Candidate areas should be easy to reach by road; this will reduce cross-country travel to the site. If possible, areas should have variable terrain and vegetation, since these characteristics are preferred by users. Candidate areas should also have some form of existing trail system -- e.g., trailbike trails, bridal trails which are not used during winter months, fire breaks, or a road system that could be closed in winter. Generally, installations which receive requests from users for snowmobile trail development are located in snowbelt States, where State or local governments are already involved in the trail development or have completed trail systems. It is recommended that candidate corridors be chosen which, through cooperative agreement, can be readily connected to existing trails. This will eliminate duplication and may reduce the long-term development and maintenance costs of support facilities and labor -- e.g., sanitary facilities and trail grooming.

Choosing the Areas

Two or more alternative areas should be chosen from the acreage which remains after all incompatible and noise-sensitive land uses and the noise buffer zones have been eliminated from consideration. (If it becomes necessary to select the limited-use alternative [p 16], the acreage in noise buffer zones is not eliminated before candidate areas are chosen; instead, use limits are

established based on the noise-sensitivity of adjacent land uses.) Natural-resource personnel who have worked on an installation for some time can supply general information about an installation's physical and environmental resources -- information which can be very useful in choosing candidate areas. Candidate areas should be marked on the base map.

5 PROCEDURES FOR EVALUATING BIOLOGICAL SUITABILITY

As noted on p 8, the evaluation method for ORRV use will vary depending on the type of vehicle being considered. For example, once candidate areas are chosen for trailbike use, the main analytical procedure is an elaborate evaluation of soil suitability (ETN 80-9, paragraph 10). Since snowmobiles operate on snow, this elaborate evaluation is not required; instead, an examination of biological suitability is the next step.

Input

Each candidate area or corridor should be field checked by a professional biologist with field qualifications. If a biologist is not assigned to the installation, the U.S. Fish and Wildlife Service (USFWS) should be consulted. AR 420-74 outlines the procedures and conditions for arranging USFWS cooperative agreements.[7]

Endangered Species

Any candidate area which contains a rare, endangered, or threatened plant species (as defined by Federal or State law), or locally important plant and animal populations (e.g., remnant prairie land) should be eliminated from consideration. No area containing a rare, endangered, or threatened animal species at any season of the year should be opened to snowmobile use until a site visit by the USFWS has confirmed that the species will not be adversely affected by the use of snowmobiles on or near that area.

Biological Ranking

After thoroughly examining each alternative site, the biologist should rank areas or corridors according to their acceptability for use. Research designed to identify the biological effects of snowmobile operation and to describe the mechanism of such effects is available.[8] However, an exact prediction of how much damage will be caused by how many machines is not possible. Therefore, the biological ranking of an area depends on the biologist's professional judgment. The impacts of snowmobile operation vary with the time of day, intensity of use, depth of snow cover, slope and slope orientation. Large mammal habitat generally is affected by noise, destruction of plant matter, disturbance of yarding areas, and increased predator access along trails. Noise causes increased movement of deer and other large mammals at times of

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[7] Natural Resources -- Land, Forest, and Wildlife Management, AR 420-74 (HQ, DA, 1 July 1977).

[8] D. F. Holecek, ed., Proceedings of the 1973 Snowmobile and Off the Road Vehicle Research Symposium, Technical Report No. 9 (Recreation Research and Planning Unit, Department of Park and Recreation Resources, College of Agriculture and Natural Resources, Michigan State University, June 1974); W. J. Wanek, A Continuing Study of the Ecological Impact of Snowmobiling in Northern Minnesota: Final Research Report for 1974-75 (The Center for Environmental Studies, Bemidji State College, 1975).

high stress during extremely cold weather. This may cause the energy budgets of these mammals to be depleted, resulting in death due to exposure. Small mammal runways may be crushed, thus restricting these animals from moving from one area to another for food or shelter. Snowmobiles tend to shear off woody plants. Spring regrowth will be slow for snow-covered herbaceous plants that the machines have run over; however, by midsummer the effects are generally not noticeable.

Rating System

To be effectively ranked, alternative corridors must be rated with comparable factors. A system of rating biological resources, including user instructions, is described in Appendix C. This rating system allows the biologist to evaluate alternative areas in either of two ways: the first asks the biologist to determine the "relative value" of the biological resources found in each corridor by comparing the resources of the area with those of the rest of the installation. If the biologist is more familiar with the damage which biological communities can sustain from ORRV use, the second method is used -- the biologist predicts an area's "susceptibility to ORRV damage."

Rank Determination

The final rating for alternative corridors is based on a simple manipulation of the "relative" or "susceptibility" values assigned by the biologist. Once each corridor has received a final rating, the rating values are compared and the corridors ranked. The corridor with the lowest biological rating is most acceptable for snowmobile use and should be ranked No. 1. The area with the second lowest rating should be ranked No. 2, and so on.

Rank Interpretation

The ranking of alternative candidate corridors provides the decision-maker with valuable, documented information for selecting areas for potential trail development. Areas or corridors with ranks of No. 1 or No. 2 should receive more consideration during site selection because, from a biological point of view, they are the most acceptable for snowmobile use.

6 HOW TO EXAMINE TERRAIN CHARACTERISTICS

A site visit and visual survey of candidate areas or corridors should be conducted to examine their suitability for trail development. As noted in Chapter 4, prime candidate areas should include some existing trail system or cleared pathways -- e.g., firebreaks -- which could be used as potential right-of-ways. During the site visit, the surveyor should identify other terrain characteristics which are both suitable and unsuitable for development. To determine these characteristics most effectively, local user groups both on and off post should be consulted. However, for general guidance, the following points should be considered.

Suitable Terrain Characteristics

Users consider variety the most desirable terrain characteristic. This includes variety in trail alignment, trailside vegetation, and scenic views.

Topography

Topography for trail and area development should include long, wide, flat areas as well as slopes. However, slopes for trail development should never exceed 30 percent. Rolling topography interrupted by wide floodplain areas should receive primary consideration.

Vegetation

Vegetation in candidate areas or along corridors should include timber stands (mature trees), brush or brush-covered openings in the tree stands, and open clearings.

Vistas

If possible, there should be points along corridors which allow for scenic vistas. These, along with proper signing and enforcement, can provide users with incentives for staying on trails.

Unsuitable Terrain Characteristics

Although terrain variety does provide certain desirable elements for trail development, there are terrain characteristics to be avoided.

Topography

For user safety as well as environmental considerations, a maximum of 25 to 30 percent slopes in candidate areas or along corridors is recommended. Areas with major streams, or streams with high, steep banks should be avoided. In fact, any area which contains a significant number of steep banks, cliffs, or deep gullies should be avoided.

Vegetation

There are few limits on the types of suitable vegetation in candidate areas, except for those places identified as incompatible because of commercial use (Chapter 2) or environmental sensitivity (Chapter 5). However, it is important to note that immature trees can be damaged by snowmobile use, and a significant number of stumps in a candidate area can present a safety hazard to users. Areas where planting or harvesting are in progress should be avoided.

Surfaces

It is recommended that areas with extremely rocky soil surfaces or wetlands be avoided. Rocky surfaces are avoided for user safety; wetlands for environmental reasons -- i.e., certain wetland soils, even when snow covered, cannot support snowmobile traffic; so the delicate biological balance of the area could be affected.

Elimination of Areas With Unsuitable Terrain Characteristics

Based on the field survey, candidate areas, or portions of candidate areas, with unsuitable terrain characteristics are eliminated from consideration. If the remaining acreage with suitable terrain characteristics is insufficient for snowmobile use, new candidate areas may have to be chosen and their biological and terrain characteristics evaluated. Of course, certain areas with unsuitable terrain characteristics may still be considered if trails are developed properly -- e.g., bridges built over streams and large stones removed from a potential trail corridor. Certain trail development procedures can be expensive but may be provided through cooperative agreement with users, organizations, or local governments. This is addressed in Chapter 7.

Consideration of Other Environmental Factors

During the site visit by the biologist or other surveyors, special attention should be paid to identifying any other significant environmental or safety factor which could adversely affect, or be affected by, snowmobile use. These factors must be considered during the site selection process and should be addressed in the environmental assessment for trail development.

7 PROCEDURES FOR ESTABLISHING A SNOWMOBILE AREA OR TRAIL

One of several goals of AR 210-9 is that ORRV operators think a designated ORRV-use area is better than areas they have been using without authorization. If this goal cannot be met, then unregulated use will create environmental and safety problems. More vigorous enforcement could theoretically confine ORRV use to a designated area, but the program would then be perceived as punitive, rather than constructive.

Site Selection

Many factors -- e.g., frozen bodies of water -- presented in this report as restrictions on the development of areas for snowmobile use will be desired by at least some users. In general, terrain variety is an absolute requirement for all users. Areas where snowmobiles may be operated, therefore, may include some "restricted" terrain or land use. However, trails should meet all exclusionary criteria discussed in Chapters 2 through 7. Site selection should be approached from the point of view of trying to provide an area that will be used voluntarily by most snowmobile operaters, rather than of trying to find some place to "stick" an unattractive nuisance.

Alternative Selection

It is recommended that at least two to three alternative sites or trail corridors be selected which meet the criteria discussed in this report. The maximum acreage allowed for development is open to judgement, but it appears that no more than 100 ha (247 acres) may be safely maintained and monitored by most installations. As noted in Chapters 4 and 6, sites or corridors which have some sort of existing trail system should be chosen. For maximum effectiveness, the ideal system could be connected to existing trails of clubs or of State and local governments -- provided installation security would not be affected by offpost, onpost, or through-post travel. The benefits of this are discussed in Chapter 6. If onpost personnel are the primary users, or if onpost, offpost or through-post use is not allowed, it should be remembered that these areas may eventually have to support sanitary facilities, safe parking areas, resting areas, and possibly picnic areas. For this development, the guidance in TM 5-803-12 should be followed.[9] Access near installation entrances should be considered, since travel to remote areas will cause difficult or congested public travel routes within the installation.

Public Involvement

ORRV-use areas should be established only in response to an expressed need. In practice, extensive unauthorized use may inform the Army planner that such need exists. The initial demand may come from offpost organizations seeking a place to operate their snowmobiles. These organizations become one segment of the public from which ideas must be solicited before the ORRV-use area is finally established. However, the concept of public participation is that all identifiable groups and persons, not just known ORRV proponents, should

[9] Planning and Design of Outdoor Recreation Facilities, TM 5-803-12 (DA, 1 October 1975).

have an opportunity to comment during the process of selecting an ORRV-use area. Appropriate, informal workshops and meetings should be held at least twice: first when initial plans and use criteria are being established, and again when candidate sites have been selected. These meetings are intended to allow constructive observations from the public before any firm decisions have been made.

A pamphlet describing public involvement as it applies to Corps of Engineers Civil Works actions is available from the command natural resource offices of the U.S. Army Training and Doctrine Command (TRADOC) and the U.S. Army Forces Command (FORSCOM), and the Natural Resources Section of the Installation and Services Activity, U.S. Army Materiel Development and Readiness Command (DARCOM).[10] Further guidance relating to the concept of public involvement as it applies to water resources planning, including associated ORRV development, may be found in Engineer Regulation (ER) 1105-2-800.[11] Once information from users and the public sector has been obtained, a use area can be chosen from the alternative sites. An area which fails to meet the needs of the potential users will be a failure.

Environmental Assessment

Before areas or trails are opened to snowmobiles, an environmental impact assessment or statement must be prepared. This is required in every case because of the controversial nature of ORRV operation. Much of the information obtained from the evaluation procedures described here should be used in preparing these documents. Information from monitoring the effects of snowmobiles should also be used in the preparation of these documents.

Outgrants for Use

Costs can be reduced if trails on installation land can be connected with existing club, State, or local trails. The trail corridor or right-of-way can be leased or outgranted to these clubs or governmental units. Through this granting process, the lessee can be required to construct facilities -- e.g., bridges and sanitary facilities -- during the season of use and provide for trail signing and maintenance. Many other requirements for use can be negotiated to benefit both the Army and the lessee. If this is done, the procedures and policies (including a report of availability) of AR 405-80 and all other appropriate regulations apply.

Trail Development

Until detailed criteria are established, the following brief outline of development suggestions should be used. Additional assistance in trail development can be obtained through user participation, public involvement, State and local agencies, the Snowmobile Safety and Certification Committee,

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[10] James R. Hanchey, Public Involvement in the Corps of Engineers' Planning Process, IWR Research Report 75-R4 (U.S. Army Engineer Institute for Water Resources, October 1975).

[11] Planning -- Public Involvement: General Policies, Engineer Regulation (ER) 1105-2-800 (DA, OCE, 2 April 1975).

Inc., the International Snowmobile Industry Association, and snowmobile and trail grooming equipment manufacturers.

Trail development should ensure that the safety of snowmobile operators is not compromised. User participation and public involvement will help identify potential safety hazards; regular inspection by qualified safety personnel is also recommended.

Length

Trail length will vary considerably depending on available acreage and system design. If trails connect with existing offpost systems, trail length is determined by access point. However, if the trail system is completely within the installation, length is determined by demand. According to Bombardier Limited, a leading manufacturer of snowmobiles and trail maintenance equipment, a well-designed trail can handle 80 snowmobiles for each 8 km (5 mi) of trail.[12] It is recommended that internal trail length be at least 6.5 km (4 mi).

Width

All trails should have a cleared surface (see *Clearances*, below) width of 3 m (10 ft) for one-way traffic and 5 m (16 ft) for two-way traffic. Trail width through turns should be larger than on straightaways to allow for safe execution of turns.

Slope

Portions of trails can climb slopes of up to 30 percent, but a maximum of 25 percent is recommended. For safety reasons, trails normally should not laterally cross slopes. But if this is necessary, the trail should be cut and filled to provide a level surface for operation. Precautionary erosion control measures should be taken for summer months. (See TM 5-630 for initial guidance on possible erosion control measures.[13])

Turns

Curves in trails should be as gradual as possible. To ensure safe operation, no trail curve should have a radius of less than 7.5 m (25 ft). Banked curves are to be avoided because they may encourage high speed and unwarranted operator confidence.

Water Hazards

If trails cross natural perennial streams, culverts or bridges should be provided. Culvert and bridge crossings should be designed to be at least 2 m (6 ft) wide and equipped with sturdy guard rails. They should also be well signed (Appendix D).

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[12] Bombardier Limited, A Guide to the Development and Maintenance of Good Snowmobile Trails (Bombardier Limited, Valcourt, Quebec, Canada, 1972).

[13] Repairs and Utilities: Ground Maintenance and Land Management, TM 5-630 (DA, 4 December 1967).

Clearances

Trees, brush, fences, and other obstacles should be removed to provide clearance for the snowmobile's runners, and for the rider's arms and legs. A lateral cleared distance of 0.3 m (1 ft) from the edge of the defined trail is necessary; vertical clearance should be at least 2.5 m (8 ft) above average snow depth. Clearance should also be provided for sight along the trail, particularly on trails with two-way traffic.

Surfaces

Before snow cover, trail surfaces should be made as level as possible. This can be done by grading and cut and fill operations. However, care should be taken to ensure proper erosion control measures (see TM 5-630).

Snow Cover

Snowmobile use on installation lands should not be allowed until the snow is 130-mm (5-in.) deep on the trail. Once this depth has been reached and use has compacted the snow, a minimum recommended depth of 75 mm (3 in.) of compacted snow should be present for continued trail use. All trails which have spots where soil is exposed must be closed to use at once, or the bare spots replenished with snow. Extensive replacement of snow is not normally warranted.

Signing

Trails should be properly signed. If trails are outgranted or leased to clubs, or to State or local governments, signing should meet the recommended standards of the lessee. In addition, all trails, whether leased or not, should be signed according to the guidelines provided in Appendix D.

Operating Conditions

In the absence of existing requirements to the contrary, it is recommended that the following minimum operation criteria initially be adopted.

License and Inspection

All vehicles operated by military personnel or their dependents should be inspected for compliance with all applicable safety regulations -- even if the vehicles do not have to be licensed or registered for operation within the State. Noncomplying vehicles should not be allowed to use the ORRV area.

All vehicles operated by unsponsored civilians residing offpost should be licensed, registered, or inspected as necessary to meet State and local requirements before being operated onpost. If applicable to State requirements, all operators should be licensed or registered as snowmobile operators in the State or in their State of residence. Young operators 10 years of age or older may be allowed to operate a complying vehicle while under the direct supervision of a parent or legal guardian who is also operating a complying vehicle.

Muffler

All snowmobiles must be equipped with factory-equivalent mufflers in good working condition.

Passengers

Passengers may be carried on a snowmobile if the number of passengers does not exceed recommended industry capacity for the particular vehicle. However, a maximum of three persons per vehicle is recommended. Trailing sleds for passengers or cargo may be allowed. A maximum of one trailing sled per vehicle is recommended.

Direction of Traffic

All trails are to be clearly and conspicuously posted for either one- or two-way traffic and are to conform to the appropriate width recommendations for one- or two-way traffic. All traffic must use trails, and no general use of off-trail lands is permitted. However, a flat, cleared area restricted to beginners may be provided.

Hours of Operation

Snowmobiles may be allowed to operate after sunset, but it is recommended that this not be permitted between 2300 and 0700 hours. It is important to note that many users prefer nighttime operation. All vehicles operated after dark must have functioning headlights and taillights. These lights must be used if snowmobiles run on or next to roadways, or on trails designated for two-way use. Vehicles may be operated along one-way trails, at night, without headlights in operation. Again, many users prefer this type of operation. If nighttime operation is not allowed, it is recommended that no snowmobile be permitted to use the trail between 15 minutes after sunset and 15 minutes before sunrise, and that no operation be allowed between 2300 and 0700 hours, regardless of the time of sunrise and sunset. This operating condition should be imposed to avoid disturbing nonparticipants during normal sleeping hours.

Roadway Operation

It is recommended that snowmobiles not be allowed on roadways normally used by other vehicles unless these roadways are closed to other traffic. Snowmobiles which are allowed to use roadways open to other vehicles should be operated on the road's right shoulder. If snowmobiles must cross roadways, they should only be allowed to cross perpendicular to the roadway.

Rules of the Road

It is recommended that snowmobiles be operated according to all applicable rules and regulations for road or highway travel, as specified by installation and State requirements. These and all operating conditions above should be adequately publicized and posted.

Supervision and Violations

To ensure that operating regulations are followed and to restrict use to designated trails and areas, it is recommended that there be supervision or patrol of the snowmobile-use areas during periods of peak use. These organized recreational activities involving ORRVs are within the scope of the Outdoor Recreation Program, and supervision or patrol may be by Recreation Services personnel or by the Military Police. Violations of the conditions listed above and other posted operating regulations are to be treated as traffic violations. Citations may be issued upon the complaint of a trail supervisor or other officer, or by any installation enforcement person authorized to issue other vehicle and traffic citations.

Maintenance and Monitoring

Once snowmobile areas and trails have been established, it will be necessary to provide appropriate trail maintenance and to monitor environmental effects.

Trail Maintenance

During use periods, grooming equipment may have to be bought or rented for trail maintenance. If trails are outgranted or leased, it is recommended that the lessee be required to provide such maintenance. If installation personnel provide maintenance, guidance on appropriate activities can be obtained from any manufacturer of trail grooming equipment and many snowmobile clubs. During summer months, periodic checks should be made to identify any maintenance problems. The most common difficulty will be erosion. Erosion control guidance in TM 5-630 should be used to provide for summer maintenance and erosion control.

Monitoring Environmental Effects

AR 201-9, paragraph 6f, provides for the development of appropriate procedures to monitor the effects of ORRV use. Once an ORRV area has been established, use and changes in use intensity can significantly impact the area. Appendix E outlines a method of monitoring this impact.

8 SUMMARY

This report has suggested a method of evaluating lands for snowmobile use. The report describes recommended procedures for identifying incompatible land uses, establishing noise buffer zones, and evaluating biological and terrain suitability. User demand and participation, environmental assessment, operating conditions, and supervision are other factors that have been considered. Guidance for choosing candidate areas, establishing and signing trails, and performing environmental monitoring also has been provided.

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APPENDIX A:

POINTS OF CONTACT IN DEVELOPMENT
OF ORRV EVALUATION PROCEDURES

The following persons were information sources for the development of the ORRV evaluation procedures. On one or more occasions, matters relative to ORRVs or the evaluation procedures were discussed with these persons. These discussions were conducted through telephone conversations, written correspondence, person-to-person interviews, or informal conference discussions.

Trailbikes

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APPENDIX B:

HOW TO DETERMINE THE DISTANCE NECESSARY FOR NOISE ATTENUATION (DNNA) WHEN ESTABLISHING SNOWMOBILE TRAILS

This appendix provides: (1) a step-by-step example of how to calculate the DNNA, or to establish use limits, (2) a list of maximum equivalent sound level (L_{eq}) requirements for selected land uses (Table B1), and (3) a listing of DNNAs which are already calculated for various noise requirement situations (Table B2).* Figure B1 shows how to use Table B2; Figure B2 is a simplified example of a base map marked with noise-sensitive land uses and noise buffer zones.

Calculation Description and Examples

The DNNA is determined by the following equation:

$$DNNA = A \times 10^{\left[\frac{B + 10(\log C) - (D - 5)^{**}}{20}\right]} \qquad \text{[Eq B1]}$$

where: DNNA = The Distance Necessary for Noise Attenuation

* There are several other factors which could be considered and alternative techniques which can be applied to determine the DNNA for ORRV use. The technique provided in this report was chosen because it is simple to use. However, it does yield very conservative results -- i.e., the resulting distances may be more than are actually needed to ensure that noise-level requirements are not exceeded. If more precise measures of DNNA are desired, the user may wish to consider additional factors -- e.g. ground cover or the presence of a noise barrier -- and use an alternative technique. Two excellent sources for alternative considerations and techniques are: (1) Environmental Protection: Planning in the Noise Environment, TM 5-803-2 (Departments of the Air Force, the Army, and the Navy, 15 June 1978), and (2) Robin T. Harrison, Roger N. Clark, and George H. Stankey, Predicting Impact of Noise on Recreationists, ED&T Project No. 2688, Project Record 8023, 1202 (U.S. Department of Agriculture, Forest Service, San Dimas Equipment Development Center, April 1980).

**The term "D-5" in the argument of Eq B1 represents a 5 dB penalty in the L_{eq} for land uses. This penalty is included as a precaution because the sound of snowmobiles can be intrustive and annoying if their muffling systems are modified.

Table B1

Maximum Acceptable Equivalent Sound Level (L_{eq})
Requirements for Selected Land Uses*

Land Use	Maximum Acceptable Sound Level (in dBA)
Agricultural (except livestock)	80
Bachelor housing	65
Campgrounds and picnic areas (not associated with ORRVs)	65
Classrooms, libraries, and churches	65
Commercial and retail stores, exchanges, movie theaters, restaurants, and cafeterias, banks, credit unions, enlisted/officers clubs	70
Dental clinic, medical dispensaries	70
Family housing	65
Flight line operations, maintenance and training	80
Gymnasiums, indoor pools	70
Hospitals, medical facilities, nursing homes (24-hr occupancy)	65
Industrial, manufacturing and laboratories	70
Livestock farming, animal breeding	75
Neighborhood parks	70
Offices and administration buildings -- military	70
Offices -- business and professional	70
Outdoor music shells, outdoor theaters and cultural events	65

*Adapted from Figure 4-5, TM 5-803-2.

Table B1 (Cont'd)

Land Use	Maximum Acceptable Sound Level (in dBA)
Outdoor sports arenas, outdoor spectator sports	70
Playgrounds, active sport recreational areas	70
Transient lodging -- hotel, motel, etc.	65
Troop housing	65

A = The distance (feet or meters) from which sound-level measurements were taken to determine the average noise level of the snowmobiles which will use the trail

B = The average noise level (in dBA) of the snowmobiles which will use the trail

C = The estimated average daily seasonal use of the trail (projected demand). (Determined by projecting the number of vehicles which will use the trail daily, adding these numbers, including days of no use, and dividing by 60 or the number of days in the season, whichever is greater.)

D = The L_{eq} for the land use for which a buffer zone is being established or for which adjacent limited use is necessary (Table B1).

For example, assume that the projected demand for a potential snowmobile trail is an average daily seasonal use of 30 snowmobiles and that each snowmobile generates an average of 76 dBA at full throttle at 15.24 m (50 ft). Further assume that a noise buffer zone must be established around a family housing area. From Table B1 it is known that the maximum acceptable equivalent sound level for family housing is 65 dBA.

Table B2

The Distance Necessary for Noise Attenuation for Establishment of Snowmobile Use Areas (Distance in Meters)

Maximum Acceptable Equivalent Sound Level (L_{eq}) for Land Use (dBA)	Estimated Number of Snowmobiles Using the Area									Average Sound Level for Snowmobiles Using the Area (dBA at 15 m [50 ft])
	10	15	20	25	30	40	50	60	80	
65	215	264	305	341	373	431	482	527	609	73 dBA
70	121	148	171	192	210	242	271	297	343	
75	68	83	96	108	118	136	152	167	193	
80	38	47	54	61	66	77	94	94	108	
65	242	296	342	382	419	483	540	592	683	74 dBA
70	136	166	192	215	235	272	304	333	384	
75	76	94	108	121	132	153	171	187	216	
80	43	53	61	68	74	86	96	105	122	
65	271	332	383	429	470	542	606	664	767	75 dBA
70	152	187	216	241	264	305	341	373	431	
75	86	105	121	136	149	172	192	210	243	
80	48	59	68	76	84	96	108	118	136	
65	304	373	430	481	527	608	680	745	860	76 dBA
70	171	210	242	270	296	342	383	419	484	
75	96	118	136	152	167	192	215	236	272	
80	54	66	77	86	94	108	121	133	153	
65	341	418	483	540	591	683	763	836	965	77 dBA
70	192	235	271	303	332	384	429	470	543	
75	108	132	153	171	187	216	241	264	305	
80	61	74	86	96	105	121	136	149	172	
65	383	469	542	605	663	766	856	938	1083	78 dBA
70	215	264	305	341	373	431	482	527	609	
75	121	148	171	192	210	242	271	297	343	
80	68	83	96	108	118	136	152	167	193	

Table B2 (Cont'd)

Maximum Acceptable Equivalent Sound Level (L_{eq}) for Land Use (dBA)	Estimated Number of Snowmobiles Using the Area									Average Sound Level for Snowmobiles Using the Area (dBA at 15 m [50 ft])
	10	15	20	25	30	40	50	60	80	
65	430	526	608	679	744	859	961	1052	1215	79 dBA
70	242	296	342	382	419	483	540	592	683	
75	136	166	192	215	235	272	304	333	384	
80	76	94	108	121	132	153	171	187	216	
65	482	590	682	762	835	964	1078	1181	1364	80 dBA
70	271	332	383	429	470	542	606	664	767	
75	152	187	216	241	264	305	341	373	431	
80	86	105	121	136	149	172	192	210	243	
65	541	662	765	855	937	1082	1209	1325	1530	81 dBA
70	304	373	430	481	527	608	680	745	860	
75	171	210	242	270	296	342	383	419	484	
80	96	118	136	152	167	192	215	236	272	
65	607	743	858	960	1051	1214	1357	1487	1717	82 dBA
70	341	418	483	540	591	683	763	836	965	
75	192	235	271	303	332	384	429	470	543	
80	108	132	153	171	187	216	241	264	305	
65	681	834	963	1077	1179	1362	1523	1668	1926	83 dBA
70	383	469	542	605	663	766	856	938	1083	
75	215	264	305	341	373	431	482	527	609	
80	121	148	171	192	210	242	271	297	343	
65	764	936	1081	1208	1323	1528	1704	1871	2161	84 dBA
70	430	526	608	679	744	859	961	1052	1215	
75	242	296	342	382	419	483	540	592	683	
80	136	166	192	215	235	272	304	333	384	
65	857	1050	1212	1355	1485	1715	1917	2100	2425	85 dBA
70	482	590	682	762	835	964	1078	1181	1364	
75	271	332	383	429	470	542	606	664	767	
80	152	187	216	241	264	305	341	373	431	

Table 82 (Cont'd)

Maximum Acceptable Equivalent Sound Level (L_{eq}) for Land Use (dBA)	Estimated Number of Snowmobiles Using the Area									Average Sound Level for Snowmobiles Using the Area (dBA at 15 m [50 ft])
	10	15	20	25	30	40	50	60	80	
65	962	1178	1360	1521	1666	1924	2151	2356	2721	86 dBA
70	541	662	765	855	937	1082	1209	1325	1530	
75	304	373	430	481	527	608	680	745	860	
80	171	210	242	270	296	342	383	419	484	
65	1079	1322	1526	1706	1869	2158	2413	2644	3052	87 dBA
70	607	743	858	960	1051	1214	1357	1487	1717	
75	341	418	483	540	591	683	763	836	965	
80	192	235	271	303	332	384	429	470	543	
65	1211	1483	1712	1915	2097	2422	2708	2966	3245	88 dBA
70	681	834	963	1077	1179	1362	1523	1668	1926	
75	383	469	542	605	663	766	856	938	1083	
80	215	264	305	341	373	431	482	527	609	
65	1359	1664	1921	2148	2353	2717	3038	3328	3843	89 dBA
70	764	936	1081	1208	1323	1528	1704	1871	2161	
75	430	526	608	679	744	859	961	1052	1215	
80	242	296	342	382	419	483	540	592	683	
65	1524	1867	2156	2410	2640	3048	3409	3734	4312	90 dBA
70	857	1050	1212	1355	1485	1715	1917	2100	2425	
75	482	590	682	762	835	964	1078	1181	1364	
80	271	332	383	429	470	542	606	664	767	
65	1710	2095	2419	2704	2963	3421	3825	4190	4838	91 dBA
70	962	1178	1360	1521	1666	1924	2151	2356	2721	
75	541	662	765	855	937	1082	1209	1325	1530	
80	304	373	430	481	527	608	680	745	860	
65	1929	2350	2714	3034	3324	3838	4291	4701	5428	92 dBA
70	1079	1322	1526	1706	1869	2158	2413	2644	3052	
75	607	743	858	960	1051	1214	1357	1487	1717	
80	341	418	483	540	591	683	763	836	965	

Table B2 (Cont'd)

Maximum Acceptable Equivalent Sound Level (L_{eq}) for Land Use (dBA)	Estimated Number of Snowmobiles Using the Area									Average Sound Level for Snowmobiles Using the Area (dBA at 15 m [50 ft])
	10	15	20	25	30	40	50	60	80	
65	2153	2637	3045	3405	3730	4306	4815	5274	6090	93 dBA
70	1211	1483	1712	1915	2097	2422	2708	2966	3245	
75	681	834	963	1077	1179	1362	152[illegible]	1668	1926	
80	383	469	541	605	663	766	856	938	1083	
65	2416	2959	3417	3820	4185	4832	5402	5918	6834	94 dBA
70	1359	1664	1921	2148	2353	2717	3038	3328	3843	
75	764	936	1081	1208	1323	1528	1704	1871	2161	
80	430	526	608	679	744	859	961	1052	1215	
65	2711	3320	3834	4286	4695	5422	6062	6640	7667	95 dBA
70	1524	1867	2156	2410	2640	3048	3409	3734	4312	
75	857	1050	1212	1355	1485	1715	1917	2100	2425	
80	482	590	682	762	835	964	1078	1181	1364	
65	3042	3725	4301	4809	5268	6083	6801	7450	8603	96 dBA
70	1710	2095	2419	2704	2963	3421	3825	4190	4838	
75	962	1178	1360	1521	1666	1924	2151	2356	2721	
80	541	662	765	855	937	1082	1209	1325	1530	
65	3413	4180	4826	5396	5911	6925	7631	8359	9653	97 dBA
70	1919	2350	2714	3034	3324	3838	4291	4701	5428	
75	1079	1322	1526	1706	1869	2158	2413	2644	3052	
80	607	743	858	960	1051	1214	1357	1487	1717	
65	3829	4690	5415	6054	6632	7658	8562	9379	10830	98 dBA
70	2153	2637	3045	3405	3730	4306	4815	5274	6090	
75	1211	1483	1712	1915	2097	2422	2708	2966	3425	
80	681	834	963	1077	1179	1362	1523	1668	1926	
65	4296	5262	6076	6793	7441	8593	9607	10524	12152	99 dBA
70	2416	2959	3417	3820	4185	4832	5402	5918	6834	
75	1359	1664	1921	2148	2353	2717	3038	3328	3843	
80	764	936	1081	1208	1323	1528	1704	1871	2161	

Table B2 (Cont'd)

Maximum Acceptable Equivalent Sound Level (L_{eq}) for Land Use (dBA)	Estimated Number of Snowmobiles Using the Area									Average Sound Level for Snowmobiles Using the Area (dBA at 15 m [50 ft])
	10	15	20	25	30	40	50	60	80	
65	4821	5904	6817	7622	8349	9641	10779	11808	13635	100 dBA
70	2711	3320	3834	4286	4695	5422	6062	6640	7667	
75	1524	1867	2156	2410	2640	3048	3409	3734	4312	
80	857	1050	1212	1355	1485	1715	1917	2100	2425	

Maximum Acceptable Equivalent Sound Level (L_{eq}) for Land Use (dBA)	Estimated Number of Snowmobiles Using the Area Daily									Average Sound Level for Snowmobiles Using the Area (dBA at 15 m [50 ft])
	10	15	20	25	30	40	50	60	80	
65	215	264	305	341	373	431	482	527	609	73 dBA
70	121	148	171	192	210	242	271	297	343	
75	68	83	96	108	118	136	152	167	193	
80	38	47	54	61	66	77	86	94	108	
65	242	296	342	382	419	483	540	592	683	74 dBA
70	136	166	192	215	235	272	304	333	384	
75	76	94	108	121	132	153	171	187	216	
80	43	53	61	68	74	86	96	105	122	
65	271	332	383	429	470	542	606	664	767	75 dBA
70	152	187	216	241	264	305	341	373	431	
75	86	105	121	136	149	172	192	210	243	
80	48	59	68	76	84	96	108	118	136	
65	304	373	430	481	527	608	680	745	860	76 dBA
70	171	210	242	270	296	342	383	419	484	
75	96	118	136	152	167	192	215	236	272	
80	54	66	77	86	94	108	121	133	153	
65	341	418	483	540	591	683	763	836	965	77 dBA
70	192	235	271	303	332	384	429	470	543	
75	108	132	153	171	187	216	241	264	305	
80	61	74	86	96	105	121	136	149	172	

Figure B1. Example of finding the DNNA of an area using Table B2.

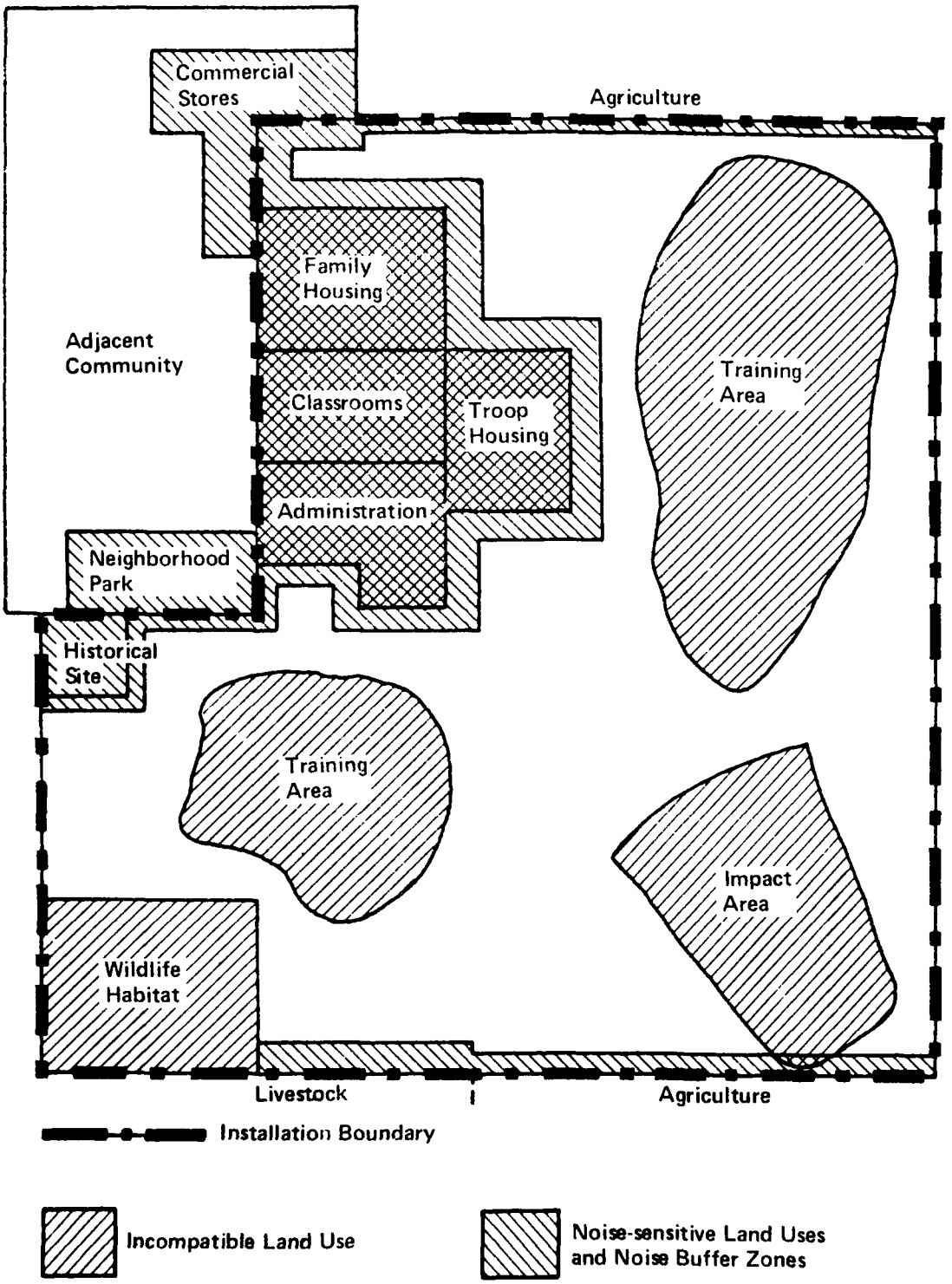


Figure B2. Noise-sensitive land uses and noise buffer zones.

Therefore:

A = 15.24 m
B = 76 dBA
C = 30 snowmobiles
D = 65 dBA for family housing

and: $$DNNA = 15.24 \times 10^{\left[\frac{76 + 10(\log 30) - (65 - 5)}{20}\right]}$$

$$DNNA = 15.24 \times 10^{\left[\frac{76 + 10(1.477) - 60}{20}\right]}$$

$$DNNA = 15.24 \times 10^{\left[\frac{76 + 14.77 - 60}{20}\right]}$$

$$DNNA = 15.24 \times 10^{\left[\frac{30.77}{20}\right]}$$

$$DNNA = 15.24 \times 10^{(1.539)}$$

$$DNNA = 15.24 \times 34.59$$

$$DNNA = 527 \text{ m.}$$

Based on this DNNA calculation, a noise buffer zone of a minimum of 527 m should be established around the family housing area. In other words, any trail with a projected average daily seasonal demand of 30 snowmobiles, each generating an average of 76 dBA at full throttle, should be no closer than 527 m from family housing.

The same example is used to illustrate the limited-use alternative for ensuring that maximum acceptable sound levels for noise-sensitive land uses are not exceeded. Assume that the projected demand for a potential snowmobile trail is an average daily seasonal use of 50 snowmobiles, each generating 76 dBA at full throttle at 15.24 m (50 ft). Further assume that the area is 527 m from family housing. Based on the above calculation, if a snowmobile trail is established at the potential site, the use must be limited to a daily average of 30 snowmobiles. Therefore, by inserting different known variables into the equation, either the size of buffer zones or use limits are determined.

Sound Level (L_{eq}) Requirements for Noise-Sensitive Land Uses

Table B1 lists the L_{eq} ratings of various noise-sensitive areas. This table was adapted from TM 5-803-2, Figure 4-5. The levels shown in TM 5-803-2 assume that a new facility is to be constructed in an existing noise environment, while Table B1 assumes that a new noise-generating land use is being developed next to an existing facility or land use. Therefore, the sound-level requirements from TM 5-803-2 had to be modified somewhat for Table B1. Since all noise-sensitive land uses could not be listed, any land use suspected to be noise sensitive should be included in the category that seems appropriate. Good judgment is essential in this determination.

Precalculated DNNAs

Table B2 lists the DNNA for various L_{eq}s and projected use parameters. All distances in the table were calculated using Eq B1. To find an appropriate DNNA on Table B2, decide:

1. The L_{eq} of the land use for which a buffer zone is needed or for which use limits must be determined.

2. The average daily seasonal use in numbers of snowmobiles (projected demand).

3. The average sound level (in dBA) which is generated by these snowmobiles.

The L_{eq} for various noise-sensitive land uses is found by examining Table B1.

The average daily seasonal use of a proposed snowmobile trail is perhaps the most difficult parameter to establish. Users and installation outdoor recreation personnel who know how to project recreation demand or who have received user requests are the best sources of local information.

To compute average daily seasonal use, estimate the number of snowmobiles which will use the trail each day of the season, including days with no use. (A season is defined as the number of days between the dates of the first and last adequate snow cover, but not fewer than 60 days. This 60-day minimum is imposed since the use of a shorter length of time is not appropriate to the principles of L_{eq} in the DNNA calculation.) Add these numbers and divide their sum by the number of days in the season. It is recommended that estimates of daily use be generous to accommodate any unexpected demand during severe winters and to allow for future increases in demand.

The average sound levels generated by snowmobiles vary. Snowmobile industry standards adopted in 1976 require that snowmobiles at a distance of 15.24 m (50 ft) generate no more than 73 dBA at 15 mph, and 78 dBA at full throttle. Older models, and especially modified models, can generate up to 120 dBA.

A user survey can help determine the model years and types of snowmobiles expected to use the trail. In addition, it is recommended that the sound

levels of a representative sample of snowmobiles which will use the trail actually be measured. If the average sound levels generated by snowmobiles cannot be accurately estimated, the following are recommended:

1. Use 78 dBA for the average noise level if most of the snowmobiles expected to use the ORRV trail were made during or after 1976. (Life expectancy of the average snowmobile is less than 3 years.)

2. Use 86 dBA for the average noise level if most of the snowmobiles expected to use the trail were made before 1976.

3. Do not allow on the trail unregulated, unregisterable, modified vehicles, or snowmobiles without mufflers.

Once use parameters are known, the DNNAs for many noise-sensitive land uses can easily be found in Table B2. The example in Figure B1 assumes an L_{eq} of 75 dBA and projected average daily seasonal use of 40 snowmobiles generating an average sound level of 77 dBA. The DNNA is 216 m (225 yd).

Once the DNNAs for each noise-sensitive land use are determined, noise buffer zones should be marked on an appropriate base map. These lines should be drawn at that distance, corresponding to the scale of the map, which illustrates the minimum distance outside which a snowmobile trail could be located. (See Figure B2 for an example.)

Table B2 can also be used to establish limits on the use of a potential snowmobile trail. Using the example shown in Figure B1, assume that a proposed trail is located 216 m (225 yd) from a livestock grazing area (L_{eq} is 75 dBA in Table B1). Also, the snowmobiles expected to use the trail generate an average sound level of 77 dBA. Therefore, use of the proposed trail must be limited to an average daily seasonal use of 40 snowmobiles to ensure that maximum acceptable sound levels are not exceeded.

APPENDIX C:

METHOD TO BIOLOGICALLY RATE AREAS
FOR RECREATIONAL SNOWMOBILE USE

AR 210-9 requires that an evaluation of areas for potential ORRV use include an examination and assessment of the biological resources of those areas. This examination should, at the minimum, determine the value of the biological elements within candidate areas. If possible, it should also consider the possible impact of ORRV use on biological resources.

Biological Rating Method

The following method will help in making a biological examination and assessment of potential snowmobile use areas. The method is systematic and is designed to be used even if quantitative data are not available. Use of the method requires a site visit and visual survey of each alternative area, and the input of a professional biologist with field qualifications. Alternative candidate areas can be rated in either of two ways: (1) the "relative value" of the biological resources of alternative areas can be examined in relation to the rest of the installation, or (2) the "susceptibility to ORRV damage" of alternative areas can be examined. (The latter is used if the biologist is familiar with the types of damage that will result from ORRV operation.) or both methods, year-round as well as seasonal conditions should be considered.

User Instructions

The following instructions are accompanied by an example for a hypothetical area. The example for the "relative value" approach is illustrated in Figure C1. The example for the "susceptibility to ORRV damage" approach is illustrated in Figure C2. A blank copy of the form used in Figures C1 and C2 is provided in Figure C3 for photocopying. The circled numbers by each step in the instructions of Figures C1 and C2 refer to corresponding numbers in the figures. They are provided to illustrate the portion of the rating form which relates to each step.

The "Relative Value" Approach

(1) Area. Assign a special designation to each alternative area or trail corridor. The designation is used to identify one area or corridor from another (e.g., "Area 1"). If a candidate area or corridor contains two or more distinct biological communities, the areas covered by the different communities should be considered separately.

① Area AREA 2

⑥ Rating 3.4 Rank 2 ⑧

Biological Limitation GROUND COVER AND ACTIVE WINTERING TERRESTRIAL ANIMALS, PARTICULARY THE PRESENCE OF JACK-IN-THE-PULPIT, DEER, AND RED FOX. ⑦

② Biological Resources	③ Relative Value	④ Categorical Value	Susceptibility to ORRV Damage	Categorical Susceptibility	Combined Resource Value	Notes
Ground Cover		4				SOUTH SLOPE
GRASSES	4					
JACK-IN-THE-PULPIT						
Understory		3				
PINE	3					
MAPLE	3					
BLUEBERRY	3					
HONEYSUCKLE	3					
Active Wintering Terrestrial Animals		4				
DEER	4					
RED FOX	4					
WILD TURKEY	3					
Inactive Wintering Terrestrial Animals		3				
SQUIRREL	3					
BOX TURTLE	2					
Pest species		3				
FERAL DOGS	3					
STARLING	3					
Other		—				
—	—					
⑤ Total Area Value		17		Total Combined Resource Value		

Figure C1. The "relative value" approach to ORRV-use potential.

Area AREA 2

(5) Rating 10.4 Rank 2 (7)

Biological Limitation ACTIVE WINTERING TERRESTRIAL ANIMALS, PARTICULARLY THE CLOSE PROXIMITY TO A DEER YARD (6)

Biological Resources	(1) Relative Value	Categorical Value	(2) Susceptibility to ORRV Damage	(3) Categorical Susceptibility	(4) Combined Resource Value	Notes
Ground Cover		4		3	12	SOUTH SLOPE
~~GRASSES~~	2		1			
~~JACK-IN-THE-PULPIT~~	4		3			
Understory		3		3	9	
~~PINE~~	3		1			OLD FIELD
~~MAPLE~~	3		1			
~~BLUEBERRY~~	3		2			
~~HONEYSUCKLE~~	3		3			
Active Wintering Terrestrial Animals		4		4	16	
~~DEER~~	4		4			EXTREMELY CLOSE TO DEER YARD
~~RED FOX~~	4		3			
~~QUAIL~~	3		2			
Inactive Wintering Terrestrial Animals		3		2	6	
~~SQUIRREL~~	3		2			
~~BOX TURTLE~~	2		2			
Pest species		3		3	9	
~~FERAL DOGS~~	3		3			GREATER ACCESS TO DEER
~~STARLING~~	3		1			
Other		—		—	—	
—	—		—			
Total Area Value			Total Combined Resource Value		52	

Figure C2. The "susceptibility to ORRV damage" approach to ORRV-use potential.

Area _____

Rating _____ Rank _____

Biological Limitation _____

_____

Biological Resources	Relative Value	Categorical Value	Susceptibility to ORRV Damage	Categorical Susceptibility	Combined Resource Value	Notes
Ground Cover						
_____						
Understory						
_____						
Active Wintering Terrestrial Animals						
_____						
Inactive Wintering Terrestrial Animals						
_____						
Pest species						
_____						
Other						
_____						
Total Area Value				Total Combined Resource Value		

Figure C3. Biological rating for ORRV-use potential.

② Biological Resources. Several categories of biological resources are listed in this column; i.e., "Ground Cover," "Understory," "Active Wintering Terrestrial Animals," "Inactive Wintering Terrestrial Animals," "Pest Species," and "Other." List under each resource category the most sensitive or easily impacted species in the candidate area and applicable to the category. There is no limitation on the absolute number of species. The number covered will vary with the habitat involved and is dependent upon the biologist's professional judgment. The biological resource "Ground Cover" should include ecologically, economically, and aesthetically important herbaceous species -- e.g., "Grasses" or "Jack-in-the-Pulpit." "Understory" is all woody plants that are susceptible to damage, including berry patches and young tree seedlings and saplings. Overstory is not considered in any aspect of the rating scheme because snowmobiles do not affect larger woody plants. "Active Wintering Terrestrial Animals" should include both animals and birds. Animals that are active in the winter, such as deer and fox, should especially be considered. "Inactive Wintering Terrestrial Animals" considers animals that hibernate or are inactive for the winter, such as ground squirrels and black bears. The category "Other" should include aspects of the biological environment that have not been considered in any of the other categories. For example, a yarding area or a particularly critical watershed that the biologist feels could be easily impacted should be included. This category should be used to include any factor which is not easily categorized. The list of biological resources may be compiled from existing data, but remember that a site visit is also required. The last column in the special rating form provides space for any remarks or notes which may be necessary to help rate an area or corridor.

③ Relative Value. In this column of the evaluation form, rate each listed biological resource. The value of the resources at each site should be rated relative to their value on the rest of the installation. When determining this value, consider the past, present, and future carrying capacity of the area in relation to the rest of the installation. The relative value is determined using the following five-point scale:

1. The resource has little importance at this location when compared to the rest of the installation.

2. The resource has some importance at this location, but its value is somewhat below average as compared to the rest of the installation.

3. The resource at this location is representative of the entire installation.

4. This location is one of the better examples of this resource relative to the rest of the installation. The value of the resource at this location can be described as somewhat above average.

5. This location is one of the very best examples of this resource as compared to the rest of the installation. The resource is much more valuable at this location than at other locations on the installation.

④ Categorical Value. Next, determine the "relative value" of each of the resource categories for which biological resources were identified. To do this, take the highest individual biological resource value under each category and assign that value to the entire category. For example, in Figure C1, the

biological resources "Grasses" and "Jack-in-the-Pulpit" have been given values of 2 and 4, respectively. Since "Jack-in-the-Pulpit" was given a value of 4, the entire resource category "Ground Cover" should be given a value of 4, the highest "relative value" in the category.

⑤ Total Area Value. Determine the "relative value" of the entire area or corridor by adding the category values. For example, the total area value of 17 in Figure C1 was determined by adding the values for the categories "Ground Cover," "Active Wintering Terrestrial Animals," and "Inactive Wintering Terrestrial Animals," and "Pest Species."

⑥ Rating. Determine the biological rating of the area or corridor by dividing the total area value by the number of resource categories for which values have been determined. In Figure C1, 17 has been divided by 5 for a value of 3.4. If the category "Other" had contained a value, the total area value would have been divided by 6. After determining the area rating, write it in the space provided near the top of the form. This allows for a quick comparison of alternative areas.

⑦ Biological Limitation. For decision-making purposes, the biological limitation of the area or corridor must be noted. The biological limitation is the resource category which has received the highest "categorical value." For example, in Figure C1, the biological limitations for the hypothetical area are "Ground Cover" and "Active Wintering Terrestrial Animals," particularly the presence of Jack-in-the-Pulpit, and deer and fox. The biological limitation shows which resources place the greatest restriction on possible ORRV use in the area. When describing the limitation, briefly explain the importance of the resource. Word the explanation so a nonbiologist can understand the logic.

⑧ Rank. The final step in this approach is to rank alternative areas. To do this, compare the biological ratings and limitation of each area or corridor. Rank the area with the lowest numerical rating No. 1. This indicates that the area is the most acceptable for ORRV use. Rank the area with the second lowest rating No. 2. Indicate any area with a biological rating of greater than or equal to 4 as unacceptable. An area with an overall rating of 4 indicates that it is one of the better examples of biological resources relative to the rest of the installation. Therefore, the area should not be used. If two areas receive the same rating, use individual judgment to determine the importance of the biological limitation before assigning the areas a ranking number. The area which is most important biologically should always receive the highest numerical value.

The "Susceptibility to Damage" Approach

This approach is used only if the biologist examining the alternative areas feels qualified to determine the susceptibility to damage of those biological resources known to exist in the area.

① Initial Steps. The first steps of this approach are the same as the first four listed in the "relative value" approach. After completing those steps, follow the procedure listed below.

② Susceptibility to Snowmobile Damage. Determine the susceptibility to damage of each of the biological resources listed under the resource categories

and, in this column, assign a susceptibility value to each resource. Impacts to "Ground Cover" species can be a result of snow compaction. When snow becomes compacted, its insulating properties decrease, resulting in lower soil temperatures. This causes slower spring growth; if spring flowers are delayed until canopy closure, these species may be lost. Outleases planted in winter crops will have reduced yields in spring. "Understory" is affected primarily by the physical destruction of the plants. The principal impacts to "Active Wintering Terrestrial Animals" result from disturbance of the habitat and noise, both on and off trail. The increased movement of both animals and birds caused by this disturbance will adversely affect the individuals' energy budgets. The severity of this impact will depend on the harshness of the winter and the duration of use; however, light use can have as much impact as heavy use within the same amount of time. If "Inactive Wintering Terrestrial Animals" are disturbed enough to merely wake up during the winter season, death could result since stored energy reserves (fat) are depleted much more rapidly when animals are awake.

Use the two separate scales described in Table C1 to assign susceptibility values. One scale applies to all resource categories except "Pest Species"; the other is used exclusively for "Pest Species." Snowmobile use can increase "Pest Species" by making prey species, such as deer, more vulnerable to predator species, such as feral dogs. The snowmobile trail may allow greater and easier access for carnivores at a time most prey animals are least able to withstand any type of stress.

③ Categorical Susceptibility. Determine the "susceptibility to snowmobile damage" for each resource category by assigning to the entire category the highest susceptibility value of that resource which received the highest relative value. For example, in Figure C2, the biological resources "deer" and "red fox" have relative values of 4. Since 4 is the highest "relative value" for resources in the category "Active Wintering Terrestrial Animals," the entire category receives a "susceptibility to ORRV damage" value of 4, the highest susceptibility value for either resource.

④ Combined Resource Value. Determine the combined resource value of each resource category by multiplying the relative values by the susceptibility to damage values. In Figure C2, the "relative value" of the category "Ground Cover," 4, is multiplied by the "susceptibility to ORRV damage" value 3. This results in a combined resources value of 12. Determine the combined resource value of the entire area by adding the combined resource values for each category. In Figure C2, this results in a total combined resource value of 52.

⑤ Rating. Determine the biological rating for the entire area by dividing the total combined resource value by the number of resource categories for which combined resource values have been determined. In Figure C2, 52 has been divided by 5 for a rating value of 10.4. (Note that if the category "Other" had contained a susceptibility value, the area's combined resource value would have been divided by 6.) As in the "relative value" approach, the area rating is placed in the space provided on the evaluation form.

Table C1

Scales for Susceptibility to Damage

SUSCEPTIBILITY TO DAMAGE FOR ALL NONPEST CATEGORIES

1. This resource will receive some damage as a result of ORRV use. Recovery time for the resource would be within 1 year; or the area is already so badly damaged from other factors that it has no logical present or future biological value.

2. This resource will be damaged by ORRV use. Recovery time for the resource would be from 1 to 5 years.

3. ORRV use will be destructive to this resource. Recovery time would be from 5 to 10 years.

4. ORRV use will be highly destructive. Recovery time for this resource would be from 10 to 100 years.

5. ORRV use will be extremely destructive to this resource. If use is allowed, the recovery time would be greater than 100 years.

SUSCEPTIBILITY TO DAMAGE FOR PEST SPECIES

1. ORRV use would not cause an increase in this species through habitat improvement or a reduction in competition; or a decrease in the species predicted.

2. ORRV use would cause a slight increase in this species.

3. A moderate increase in this species is expected as a result of ORRV use.

4. A large increase in this species is expected as a result of ORRV use.

5. ORRV use would reduce competition or improve habitat for this species such that a very large increase in the pest population is expected.

---

⑥ Biological Limitation. To help in the decision-making process, the biological limitation of an area must be recorded. Determine the limitation by examining the combined resource value of each resource category. The highest individual category value determines the biological limitation. In Figure C2, the limiting factor is "Active Wintering Terrestrial Animals." This category has a combined resource value of 16, the highest of all categories. In this case, the presence of a nearby deer yard (which could be significantly affected by ORRV use) presents the greatest biological restriction.

⑦ Rank. To rank areas, compare the biological rating for each alternative site. Rank No. 1 the area with the lowest numerical rating. The area with this ranking is the most acceptable for ORRV use. Any area which has a rating of greater than or equal to 16 is not normally acceptable for ORRV use. A rating of 16 or greater indicates that the area has excellent resources relative to the rest of the installation, and ORRV use would be relatively more destructive.

Ranking Interpretation

As stated in the instructions to both approaches, the area which receives the lowest numerical rating is ranked No. 1; the area with the second lowest numerical rating is ranked No. 2. The area ranked No. 1 is more acceptable for ORRV use than the area ranked No. 2. To make evaluations comparable, the same rating approach is used for each area being evaluated. When choosing a site for snowmobile use, special consideration should be given to areas ranked No. 1 or 2. If possible, the use area should be the one ranked No. 1. This will help minimize damage to the biological resources of the installation.

APPENDIX D:

TRAIL SIGNING GUIDELINES FOR
RECREATIONAL SNOWMOBILE TRAILS

To ensure safe operation along snowmobile trails and to route traffic only along designated trails, the following guidelines for posting signs are recommended. These were adopted primarily from the State of Wisconsin's trail signing handbook. For general guidance, and in the absence of any regulatory criteria, trail signing, except where specified, should also follow Federal and State requirements for roads and highways.

General Guidelines

1. All trail signs should be reflectorized. Many types of materials are being used to manufacture trail signs. Most are acceptable as long as color, size, and shape standards are followed. Lightweight signs will require backing material. Reflective material can be added to nonreflective signs.

2. Signs should be placed as late in the fall as possible and, where feasible, removed at the end of the season to reduce the potential for vandalism.

3. Generally, all trail signs should be placed to the right of the trail to conform to the user's familiarity with highway signs.

4. Adequately sized posts should be used to provide stability and to deter vandalism. For caution and stop signs, 4-in. square or 3-in. round posts can be used. Metal posts can also be used.

5. Signs should be attached to posts with bolts or lag screws; cardboard signs can be stapled. Normally only one sign should be placed on a post. If two signs must be used, the more important one should be placed on top.

6. Trail signing should be done by a small group or groups familiar with trail signing guidelines to retain as much uniformity as possible.

7. Overuse of all signs should be avoided. Only authorized trail signs should be allowed on trails to avoid clutter and confusion.

8. Extra signs should be carried with trail patrols so that vandalized signs can be replaced.

9. Signs and posts should be carefully placed with regard to brush, line-of-sight, and anticipated snow depths.

10. If installation roads are used as part of the trail system, permanent road signs can be used if applicable. Trail blazer signs should be attached directly under the road sign.

11. Sign sizes should be standard; see Figure D1.

Sign Language and Interpretation

1. Regulatory (Figure D2).

2. Caution. Posted with appropriate warnings. Universal symbols and warnings are used. Figure D3 presents some examples.

3. Trail markers (Figure D4).

4. Informational. Posted with appropriate information -- e.g., miles of trail ahead, emergency medical assistance ahead. These are optional and should conform to universal signing. Figure D5 presents some examples.

5. Bridges, barriers, and gate markers. Bridges, barriers, and gates should be posted with the same types of markers. Figure D6 shows where the signs should be placed.

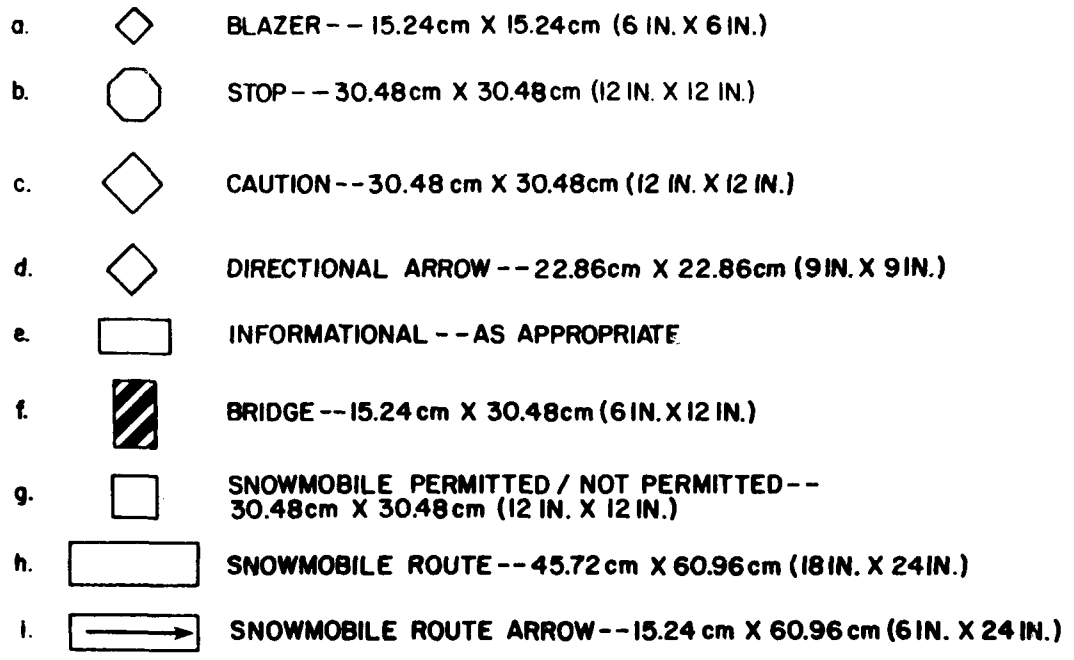


Figure D1. Standard sign sizes.

STOP SIGN

PURPOSE: TO HALT USERS AT ROAD AND RAILROAD CROSSINGS. OPTIONAL AT TRAIL INTERSECTIONS. IN SITUATIONS OF EXTREME DANGER THEY SHOULD BE PLACED ON BOTH SIDES OF TRAIL.

BACKGROUND: RED

BORDER AND LEGEND: SILVER

SNOWMOBILES PERMITTED

PURPOSE: TO INDICATE SNOWMOBILE TRAILS AND USE AREAS.

BACKGROUND: SILVER

LEGEND: GREEN CIRCLE, BLACK SNOWMOBILE SYMBOL

SNOWMOBILING NOT PERMITTED

PURPOSE: TO INDICATE AREAS WHERE SNOWMOBILING IS NOT PERMITTED.

BACKGROUND: SILVER

LEGEND: RED CIRCLE AND SLASH, BLACK SNOWMOBILE SYMBOL

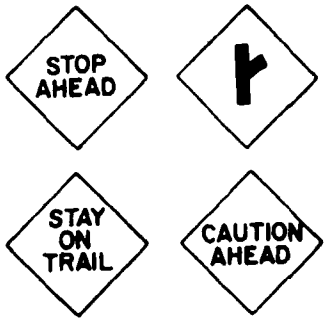
ONE-WAY: DO NOT ENTER

PURPOSE: TO INDICATE THE WRONG DIRECTION OF TRAVEL ALONG A ONE-WAY TRAIL.

BACKGROUND: SILVER

LEGEND: RED CIRCLE AND SLASH BLACK ARROW SYMBOL

Figure D2. Regulatory signs.



WARNING SIGNS

PURPOSE TO INDICATE HAZARDS ALONG THE TRAIL

BACKGROUND: YELLOW

BORDER AND LEGEND: BLACK

Figure D3. Caution signs.

SNOWMOBILE ROUTE AND ARROW

PURPOSE: TO ALERT TRAIL USER THAT TRAIL MAY BE USED. TO ALERT ROADWAY TRAFFIC THAT SNOWMOBILES ARE USING ROUTE.

BACKGROUND: GREEN

LEGEND: WHITE SNOWMOBILE SYMBOL AND LETTERS, BLACK ARROW

TRAIL BLAZER

PURPOSE: TO REASSURE THE USER THAT HE OR SHE IS ON THE TRAIL.

BACKGROUND: ORANGE

DIRECTIONAL ARROW

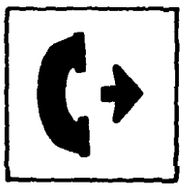
PURPOSE: TO WARN THE TRAIL USER OF A SUDDEN CHANGE IN TRAIL DIRECTION

BACKGROUND: ORANGE

LEGEND: BLACK

Figure D4. Trail markers.

INFORMATIONAL SIGNS



PURPOSE: TO PROVIDE USER WITH ANY APPROPRIATE INFORMATION ABOUT HIS LOCATION, THE LOCATION OF FACILITIES, OR DISTANCES.

BACKGROUND: BROWN OR BLUE

LEGEND: WHITE

Figure D5. Informational signs.

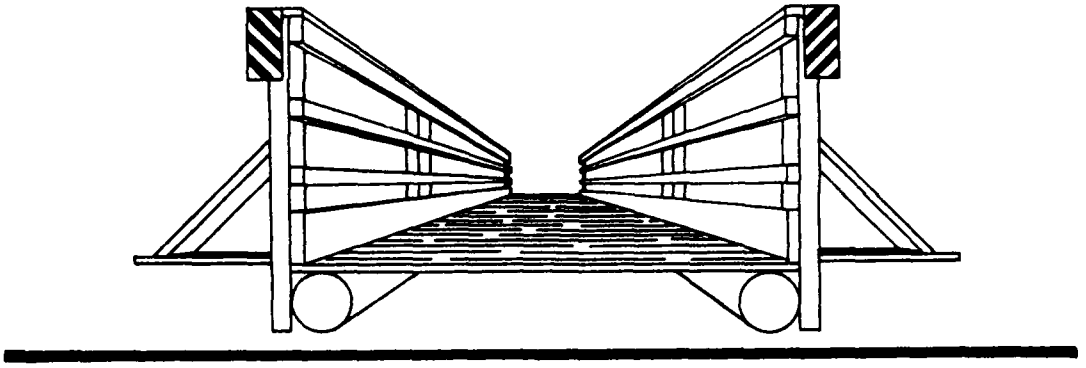
BRIDGE MARKERS

PURPOSE: TO WARN OF BRIDGE OBSTRUCTIONS.

BACKGROUND: WHITE (REFLECTORIZED)

LEGEND: BLACK (REFLECTORIZED) 45-DEGREE DIAGONAL STRIPES FACING INWARD

BRIDGE MARKER PLACEMENT (RAILINGS)



BRIDGE MARKER PLACEMENT (NO RAILINGS)

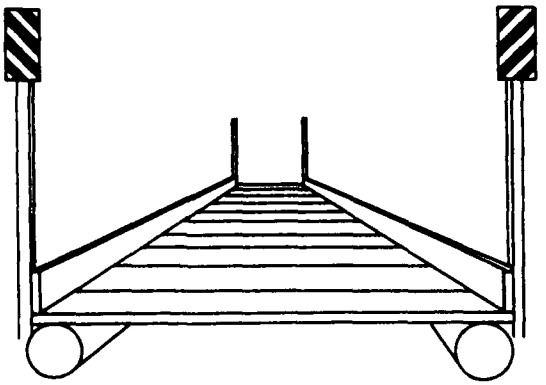


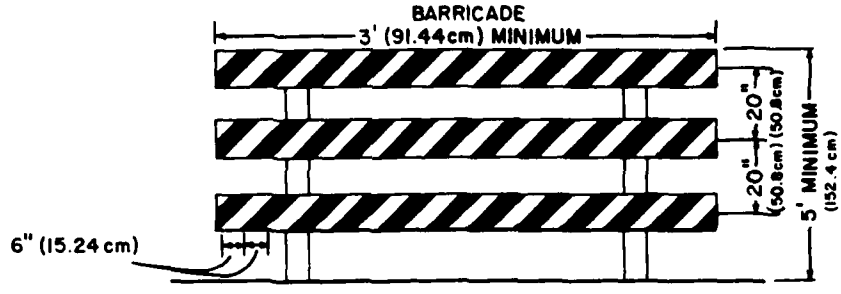
Figure D6. Bridges, barriers, and gate markers.

BARRICADE AND GATE MARKERS

PURPOSE: TO WARN OF BARRIER AND GATE OBSTRUCTIONS.

BACKGROUND: WHITE (REFLECTORIZED)

LEGEND: ORANGE (REFLECTORIZED) 45-DEGREE DIAGONAL STRIPES ALL FACING THE SAME DIRECTION



BARRIER AND GATE MARKING STANDARDS

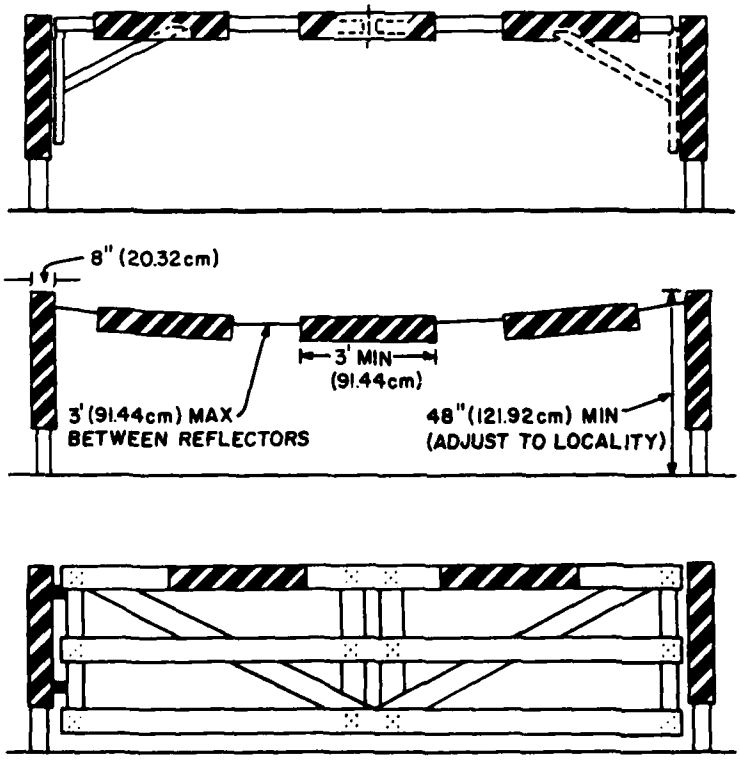


Figure D6. (Cont'd).

APPENDIX E:

MONITORING THE ENVIRONMENTAL EFFECTS
OF RECREATIONAL SNOWMOBILE USE

AR 210-9 requires establishment of appropriate procedures to monitor the effects of the use of ORRVs on Army installations. This monitoring is to be the basis for changes in installation policy concerning ORRV use.

Table E1 outlines a method of monitoring the environmental effects of snowmobile use, and was adopted from Appendix D of ER 1130-2-405.[14] Table E1 is not intended to take the place of a disciplined scientific study, but is a limited method designed to monitor effects while taking into consideration budgetary constraints and personnel ceilings. This monitoring plan is very similar to those established by other Federal agencies with similar constraints.

A comparison of all data records collected over 5 years will help to determine the environmental effects of snowmobile use. However, at this time only professional judgment can be used to determine if impacts are significant and if installation policy concerning ORRV use in a specific area should be changed. This judgment should be solicited from professionals with expertise in various environmental disciplines, particularly biology, earth science, and soils.

Table E1

Method of Monitoring Environmental Effects of
Recreational Snowmobile Use

1. Estimate use of the area or trails by snowmobile users.

2. Determine impact of ORRV use on vegetation and soil.

   a. Map existing trails in designated ORRV area.

   b. Record mileage and average width of existing trails.

   c. Rate existing trails according to light, medium, or heavy use.

   d. On and along existing trails, select random sample plots which are representative of a variety of terrain, vegetative, and soil conditions.

      (1) Photograph sample plots.

      (2) Record trail width at selected intervals. Also record other notable features, such as potholes and ruts, along entire trail length.

[14] Project Operation: Use of Off-Road Vehicles on Civil Works Projects, ER 1130-2-405 (DA, OCE, 17 January 1974).

Table E1 (Cont'd)

(3) Record inventory of vegetative community along trails. Inventory should include species composition, size of woody vegetation, and number of dead stems greater than 20 mm in diameter.

(4) Record general condition of vegetation along trail. Note damaged tree bark and roots, and condition of herbaceous vegetation.

e. Record initially, and at intervals of 1, 3, and 5 years, those items included in d, above.

f. Define control plots near test plots to determine impact with and without ORRV use. Control plots should be approximately 18 m (60 ft) from trail center. Record all appropriate information on control plots for comparison with sample plots.

g. Permanently but inconspicuously mark all control and test plots so that photographs and data collection can be done in the same area in subsequent years.

h. Determine the following from test sections:

(1) Impact on young vegetative growth.

(2) Impact on larger trees and shrubs (compaction, direct damage, root exposure).

(3) Impact on soil (erosion, compaction, lateral movement).

(4) Trail width and depth variation from year to year.

(5) Extent of impact on either side of trail. Changes in trail, such as expansion of potholes and ruts.

(6) Comparison of ORRV impact on test plots with control plots.

i. Annually spot-check vulnerable areas such as steep slopes, creek banks, and lake shoreline. Record any noticeable increases in erosion or other damage.

3. Determine ORRV impact on wildlife.

a. Record track counts of big game animals such as deer, antelope, and elk in ORRV area and compare to those outside ORRV area.

b. Count game birds and nongame birds by their songs.

c. If hunting is permitted, compare wildlife harvest in ORRV area to that of other areas on the installation.

d. Record sightings of game and nongame species in and outside ORRV-use area.

Table E1 (Cont'd)

4. Determine ORRV impact on other activities.

a. Su vey type and amount of recreation and other use in areas adjacent to designat.d ORRV-use area.

b. Record as accurately as possible the attitudes of persons who are surveyed.

c. Record distance between area where survey is made and the ORRV area.

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ATTN: DAEN-MPC
ATTN: DAEN-MPE
ATTN: DAEN-MPO
ATTN: DAEN-MPR-A
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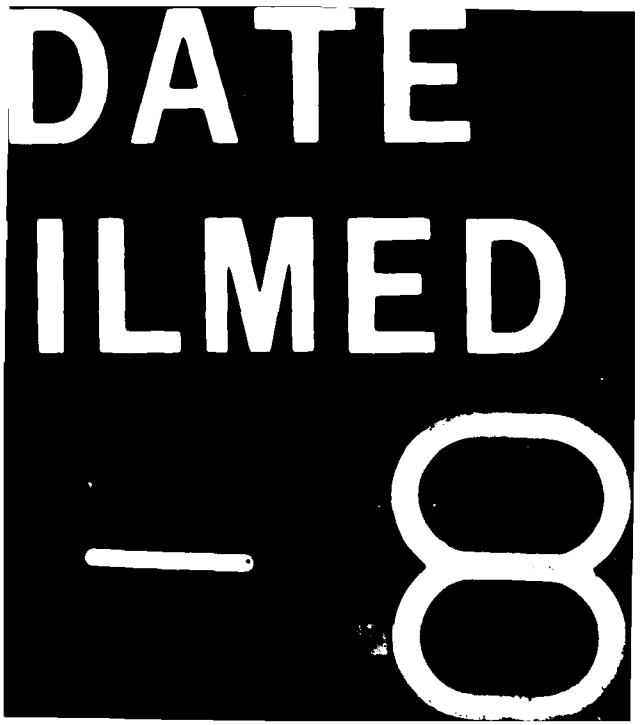
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